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WET WIPES CONTAINER HAVING IMPROVED STRENGTH

RELATED APPLICATION

5 This application claims the priority of U.S. application Serial No. 60/202,290 of inventors Yung H. Huang et al. filed May 5, 2000, which is incorporated herein by reference.

DESCRIPTION OF THE RELATED ART

10 Wet wipes are well known commercial consumer products which have been available in many forms. Perhaps the most common form of wet wipes has been a stack of moistened sheets which have been packaged in a plastic container. The wet wipes have been made from a variety of materials which have been moistened with a variety of suitable wiping solutions. Typically, the wet wipes have been stacked in the container in
15 either a folded or unfolded configuration. For example, containers of wet wipes have been available wherein each of the wet wipes stacked in the container has been arranged in a folded configuration such as a c-folded, z-folded or quarter-folded configuration as are well known to those skilled in the art. Some of the folded wet wipes have also been interfolded with the wet wipes immediately above and below in the stack of wet wipes. In an
20 alternative configuration, the wet wipes have been placed in the container in the form of a continuous web of material which includes perforations to separate the individual wet wipes and which is wound into a roll. Such wet wipes have been used for baby wipes, hand wipes, household cleaning wipes, industrial wipes and the like.

The conventional packages which contain wet wipes, such as those described
25 above, have typically been designed to be positioned on a flat surface such as a countertop. Such conventional packages have generally provided a plastic container or tub which provides a sealed environment for the wet wipes to ensure that they do not become overly dry. Some of the conventional packages have also been configured to provide one at a time dispensing of each wet wipe which can be accomplished using a
30 single hand after the package has been opened. Such single handed, one at a time dispensing is particularly desirable because the other hand of the user or care giver is typically required to be simultaneously used for other functions. For example, when changing a diaper product on an infant, the care giver typically uses one hand to hold and maintain the infant in a desired position while the other hand is attempting to dispense a
35 baby wipe to clean the infant.

However, the opening of such conventional containers for wet wipes has not been completely satisfactory. For example, many conventional containers are not capable of being opened by a single hand or, if designed for opening by a single hand, are not easy to open with a single hand for all users. In such containers, the user typically has to open the package with both hands before dispensing a wet wipe. Many of such containers have been hard to open because they have included a cover which provides a positive frictional seal with the container body when closed to ensure that the wet wipes do not become overly dry. In addition, many conventional containers have included relatively small opening mechanisms which are difficult to manipulate with a single hand.

Another difficulty associated with conventional containers for wet wipes is that the lids of the containers typically must either be completely open or completely closed. Depending on the weight of the wet wipes remaining in the container, the container may tip backwards from the weight of an open lid. Therefore, conventional containers do not provide for a partially open position between the lid and the base of the container. Consequently, as the supply of wet wipes in the container is depleted, it becomes more difficult to obtain a wipe from the container using a single hand. In some conventional containers, there is poor alignment between the container lid and the container base. The poor alignment hinders the user's ability to secure the lid to the base, particularly when the operation must be done with a single hand.

With some wet wipe uses, such as with wet wipes for diaper changes, the container holding the wipes is opened and closed with great frequency. Frequent opening and closing of the container lid causes wear and stress on the connection or attachment between the lid and the base. After a number of opening and closing cycles, the connection can begin to fail and, in some cases, will result in the container lid tearing away from the container base. The rough surface produced by a torn lid can catch on skin or on fabric, thus becoming a nuisance. In the past, the exterior contours of some conventional containers have had right angles with rough edges that can catch on skin or fabric. For example, right angles often exist at the connection point between container lids and container bases.

During shipping and storage of the containers, the containers are often stacked vertically on top of each other. The stacking can be done on a pallet or within a shipping/storage container. The vertical stacking of the containers on top of each other results in a substantial force acting on the top of the container. If the container does not have sufficient compressive strength, the lid or base can become deformed by outward bowing or buckling. Some conventional containers have not been designed to withstand the magnitude of force experienced during routine shipping and storage.

SUMMARY OF THE INVENTION

In response to the difficulties and problems discussed above, a new container for
5 wet wipes that can have improved opening and dispensing, can be capable of maintaining
a partially open position, can have improved alignment between lid and base, can have
improved tear resistance and can have improved compression strength has been
discovered. The purposes and advantages of the present invention will be set forth in and
apparent from the description that follows, as well as will be learned by practice of the
10 invention. Additional advantages of the invention will be realized and attained by the
containers particularly pointed out in the written description and claims hereof, as well as
from the appended drawings.

In one aspect, the present invention relates to a wet wipe container that includes a
container base and a container lid. The container lid is connected to the container base.
15 The container lid and the container base can be a single component or can be separate
components. The connection between the container lid and the container base can be in
the form of an ultrasonic bond, an interlocking hinge or other form of connection known in
the art. The container lid has a top and a front wall, a rear wall and a pair of opposed side
walls. The walls extend downwardly from the top of the container lid in a generally
20 rectangular configuration. The walls can also extend downward in a generally trapezoidal
configuration. The container base has a bottom and a front wall, a rear wall, and a pair of
opposed side walls. The walls extend upwardly from the bottom of the container base in a
generally rectangular configuration to provide an interior for containing the wet wipes. The
walls can also extend upward in a generally trapezoidal configuration.

25 The container lid can be fabricated from a polymer, copolymer or mixtures of both.
For example, the container lid can be made primarily of a copolymer of styrene-butadiene-
styrene. The container lid can be transparent or translucent to, in part, facilitate
determination of the quantity of wipes remaining in the container. The container base can
likewise be fabricated from a polymer, copolymer or mixtures of both. For example, the
30 container base can be primarily made of polystyrene. The container base can be made of
either an opaque, translucent or transparent material. Dyes, tints and colorants can be
added to the material of either the container lid or the container base. The wet wipe
containers of the invention can be beneficially used for secondary purposes when they are
no longer used to contain wet wipes. For example, the containers can be used to store
35 small toys, art supplies and other household items. When the container lid and container

base are translucent or transparent, it is possible to see what is inside of the container without opening the lid.

The corners that are formed at the intersections of the various walls of the container lid and the container base can be rounded. More particularly, the corners
5 between the front walls, the rear walls, the side walls, the top and the bottom can be curvilinear. The container lid and the container base can be joined together at their respective rear walls. The container lid and the container base can be joined or connected by the variety of ways known in the art including by ultrasonic bonds.

In another aspect, the present invention relates to a wet wipe container including a
10 container base and a separate container lid that is attached to the container base. The container lid can be attached to the container base in a variety of ways including by a hinge arrangement, by pins, by interlocking edges, by ultrasonic bonding and other ways of attachment known in the art. The container lid has a top and a front wall, rear wall and a pair of opposed side walls. The walls extend downwardly from the top in a generally
15 rectangular configuration.

The container lid and the container base can be either transparent or translucent to provide an indication of the quantity of wet wipes remaining in the container. The container lid and the container base can be made of various polymers, copolymers, and mixtures including polystyrene and mixtures including polystyrene. The various corners
20 formed by the front walls, rear walls, side walls, the top and the bottom of the container lid and the container base can be curvilinear.

In another aspect, the present invention relates to a wet wipe container that includes a container base, a container lid and a closure. The container lid is connected to the container base and either the container lid itself can include a hinge or a hinge can be
25 formed between the container lid and the container base. As an example of the connection between lid and base, the container lid and the container base can be ultrasonically bonded together. The closure is configured to releasably hold the container lid on the container base in a closed position.

In yet another aspect, the present invention relates to a wet wipe container that
30 includes a container base and a container lid that is connected to the container base. The container base includes a bottom and a front wall, rear wall and a pair of opposed side walls. The walls extend upwardly from the bottom in a generally rectangular configuration to provide an interior for containing the wet wipes. The walls can include one or more generally linear ribs that are formed into the walls. The ribs can be vertical or horizontal.
35 The ribs can extend along the entire length or width of the wall(s) or the ribs can extend only along a portion of the length or width of the wall(s). The ribs provide the container

with improved compression strength to resist the crushing or buckling that may occur during shipping and storage. The ribs also provide a more aesthetic appearance to the container.

In still another aspect, the present invention relates to a wet wipe container
5 including a container base and a container lid that is connected to the container base. The container base includes a bottom and a front wall, a rear wall and a pair of opposed side walls that extend upwardly from the bottom to provide an interior for containing the wet wipes. For at least two opposing walls from the group consisting of the front wall, the back wall and the opposed side walls, each opposing wall has a plurality of generally
10 linear ribs formed therein wherein the plurality of generally linear ribs provide an enhanced compression strength to the respective wall by more evenly spreading out an applied compression force for the respective walls having the plurality of generally linear ribs formed therein.

In yet another aspect, the present invention relates to a wet wipe container
15 including a container base and a container lid that is connected to the container base. The container base includes a bottom and a front wall, a rear wall and a pair of opposed side walls that extend upwardly from the bottom to provide an interior for containing the wet wipes. A portion of the wall from the group consisting of the front wall, the back wall and the opposed side walls, has a length dimension and a width dimension. There is also
20 provided means for increasing a surface area of the portion of the wall while still maintaining the same length dimension and the same width dimension for the portion of the wall to thereby improve the compression strength of the portion of the wall.

Thus, the present invention, in its various aspects, advantageously relates to a container for wet wipes that, when compared to conventional containers of wet wipes,
25 provides convenient single handed access to the wet wipes. In particular, the present invention provides an aesthetically pleasing container for wet wipes that has an easy-to-use and ergonomic closure. The containers are particularly desirable for baby wipes intended for use in the typical diaper changing routine in which usually only one of the hands of the care-giver is available for retrieval of a wet wipe. Additionally, the container
30 of the invention provides better compression strength and, therefore, improved resistance to crushing and buckling.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and are intended to provide further explanation of the invention claimed. The accompanying drawings, which are incorporated in and constitute
35 part of this specification, are included to illustrate and provide a further understanding of

the containers of the invention. Together with the description, the drawings serve to explain the various aspects of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

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The drawings are merely representative and are not intended to limit the scope of the claims. Like parts of the containers depicted in the drawings are referred to by the same reference numerals.

FIG. 1 representatively shows a perspective view of an example of a container for
10 wet wipes according to the present invention in a closed position;

FIG. 2 representatively shows a perspective view of the container for wet wipes illustrated in FIG. 1 in an open position;

FIG. 3 representatively shows a top plan view of the container for wet wipes illustrated in FIG. 1;

15 FIG. 4 representatively shows a bottom plan view of the container for wet wipes illustrated in FIG. 1;

FIG. 5 representatively shows a front elevational view of the container for wet wipes illustrated in FIG. 1;

20 FIG. 6 representatively shows a rear elevational view of the container for wet wipes illustrated in FIG. 1;

FIG. 7 representatively shows a cross-sectional end view of the container for wet wipes illustrated in FIG. 1;

FIG. 8 representatively shows an expanded top plan view of the container lid of the container for wet wipes illustrated in FIG. 1;

25 FIG. 8A representatively shows an expanded cross sectional view of a portion of the container lid of the container for wet wipes illustrated in FIG. 8, taken along the line 8A;

FIG. 8B representatively shows an expanded cross sectional view of a portion of the container lid of the container for wet wipes illustrated in FIG. 8, taken along the line 8B;

30 FIG. 9 shows a perspective view of an instrument used to measure tear resistance (closed position);

FIG. 10 shows a perspective view of an instrument used to measure tear resistance (open position);

FIG. 11A representatively shows a cross sectional view of a portion of a front wall of the container for wet wipes illustrated in FIG. 5, taken along the line A-A;

FIG. 11B representatively shows an alternate embodiment of a cross sectional view of a portion of a front wall of a container for wet wipes similar to that illustrated in FIG. 11A;

FIG. 11C representatively shows another alternate embodiment of a cross sectional view of a portion of a front wall of a container for wet wipes similar to that illustrated in FIG. 11A;

FIG. 11D representatively shows another alternate embodiment of a cross sectional view of a portion of a front wall of a container for wet wipes similar to that illustrated in FIG. 11A;

FIG. 11E representatively shows another alternate embodiment of a cross sectional view of a portion of a front wall of a container for wet wipes similar to that illustrated in FIG. 11A;

FIG. 12 representatively shows a graph of a compression strength test run for a container like the container of the invention in all regards but without any generally linear ribs formed in the container walls; and,

FIG. 13 representatively shows a graph of a compression strength test run for a container of the invention like that seen in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

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As representatively illustrated in FIGS. 1-8 and 11A to 11E, inclusive, the present invention provides a wet wipe container 20 that is configured to dispense wet wipes in a convenient and reliable manner for personal use. The wet wipe container 20 includes a container base 22 and a container lid 24 that is connected or attached to the container base 22. The container base 22 and the container lid 24 can be formed as a single piece or they can be separate pieces. The container lid 24 can be connected to the container 22 by various mechanical and chemical methods known in the art, including, but not limited to, hinges, interlocking members, use of glue or other bonding material or ultrasonic bonding.

30

The wet wipes may be arranged in the container 20 in any manner which provides convenient and reliable one at a time dispensing and which ensures that the wet wipes do not become overly dry. For example, the wet wipes may be arranged in the container 20 as a plurality of individual sheets arranged in a stacked configuration to provide a stack of wet wipes which may or may not be individually folded. The wet wipes may be individual wet wipes which are folded in a c-fold or z-fold configuration as are known to those skilled in the art and then stacked on top of each other to provide the stack of wet wipes.

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Alternatively, if the wet wipes are to be arranged in a stacked configuration in the container 20, the individual wet wipes may be interfolded such that the leading and trailing end edges of successive wipes in the stacked configuration overlap. In such a configuration, the leading end edge of the trailing wet wipe is loosened from the stack by the trailing end edge of the leading wet wipe as the leading wet wipe is removed by the user. The wet wipes may be interfolded to facilitate such dispensing by means known to those skilled in the art.

Alternatively, the wet wipes may be arranged in the container 20 as a continuous web of interconnected wet wipes which are folded in an accordion-like stacked configuration. The individual wet wipes may be connected together along lines of frangibility, such as lines of perforations, to ensure that the trailing wet wipe is in position for grasping by the user after the leading wet wipe is removed. For example, the wet wipes may be provided by a continuous web of material which has a series of lines of frangibility extending across the width of the web. The portion of the web of material between successive lines of frangibility provides each individual wet wipe. The lines of frangibility may be provided by means known to those skilled in the art such as perforations, indentations or cuts in the web of material. For example, the lines of frangibility or perforations may be provided in the web of material by passing the web of material between a die cutter roll and anvil roll. After the lines of frangibility have been incorporated into the web of material, the web may then be arranged in a stacked configuration for easy insertion into the interior 38 of the container 20.

The wet wipe container 20 of the present invention can comprise any suitable number of individual wet wipes depending upon the desired packaging and end use. For example, the container 20 may be configured to include a stack of wet wipes which may include at least about 5 wet wipes and desirably from about 16 to about 320 individually wet wipes.

Each wet wipe is generally rectangular in shape and defines a pair of opposite side edges and a pair of opposite end edges which may be referred to as a leading end edge and a trailing end edge. The leading end edge of each wet wipe is typically positioned in the container 20 to be grasped by a user to facilitate a removal of the wet wipe from the container 20. Each wet wipe defines an unfolded width and an unfolded length. The wet wipe may have any suitable unfolded width and length. For example, the wet wipe may have an unfolded length of from about 2.0 to about 80.0 centimeters and desirably from about 10.0 to about 25.0 centimeters and an unfolded width of from about 2.0 to about 80.0 centimeters and desirably from about 10.0 to about 45.0 centimeters.

Materials suitable for the wet wipes of the present invention are well known to those skilled in the art. The wet wipes can be made from any material suitable for use as a moist wipe, including meltblown, coform, air-laid, bonded-carded web materials, hydroentangled materials and the like and can comprise synthetic or natural fibers or combinations thereof. The wet wipes may have a basis weight of from about 25 to about 120 grams per square meter and desirably from about 40 to about 90 grams per square meter.

In a particular aspect, the wet wipes may comprise a coform basesheet of polymeric microfibers and cellulosic fibers having a basis weight of from about 60 to about 80 grams per square meter and desirably about 75 grams per square meter. Such coform basesheets are manufactured generally as described in U.S. Patent No. 4,100,324 to Anderson et al. which issued July 11, 1978, and which is herein incorporated by reference. More particularly, such coform basesheets can be manufactured as are described as part of recently filed U.S. Patent Application Serial No. 09/751329, filed on December 29, 2000 entitled, "Composite Material With Cloth-like Feel" of inventors Scott R. Lange et al., and which is incorporated herein by reference. Typically, such coform basesheets comprise a gas-formed matrix of thermoplastic polymeric meltblown microfibers, such as, for example, polypropylene microfibers, and cellulosic fibers, such as, for example, wood pulp fibers. The relative percentages of the polymeric microfibers and cellulosic fibers in the coform basesheet can vary over a wide range depending on the desired characteristics of the wet wipes. For example, the coform basesheet may comprise from about 20 to about 100 weight percent, desirably from about 20 to about 60 weight percent, and more desirably from about 30 to about 40 weight percent of polymeric microfibers based on the dry weight of the coform basesheet being used to provide the wet wipes.

The wet wipes of the different aspects of the present invention contain a liquid which can be any solution which can be absorbed into the wet wipes. The liquid contained within the wet wipes may include any suitable components which provide the desired wiping properties. For example, the components may include water, emollients, surfactants, preservatives, chelating agents, pH buffers or combinations thereof. The liquid may also contain lotions, ointments and/or medicaments.

The amount of liquid contained within each wet wipe may vary depending upon the type of material being used to provide the wet wipe, the type of liquid being used, the type of container being used to store the stack of wet wipes, and the desired end use of the wet wipe. Generally, each wet wipe can contain from about 150 to about 600 weight percent, or from about 250 to about 450 weight percent liquid based on the dry weight of the wipe for improved wiping. In a particular aspect wherein the wet wipe is made from a coform

material comprising from about 30 to about 40 weight percent polymeric microfibers based on the dry weight of the wipe, the amount of liquid contained within the wet wipe is from about 300 to about 400 weight percent or about 330 weight percent based on the dry weight of the wet wipe. If the amount of liquid is less than the above-identified range, the wet wipes may be too dry and may not adequately perform in certain situations. If the amount of liquid is greater than the above-identified range, the wet wipes may be oversaturated and soggy and the liquid may pool in the bottom of the container.

As illustrated in FIGS. 1-8, the wet wipe container 20 includes a container base 22 that defines a bottom 28 that is connected to a front wall 30, a rear wall 32, and a pair of opposed side walls 34 and 36. The front, rear and side walls extend upwardly from the bottom 28 in a generally perpendicular manner to form a rectangular container base 22. The container base 22 can also have a trapezoidal shape. The bottom and front, rear and side walls of the container base 22 generally define an open interior 38 for containing the wet wipes. The wet wipe container 20 also includes a container lid 24 that defines a top 40 that is connected to a front wall 42, a rear wall 44 and a pair of opposed side walls 46 and 48. The front, rear and side walls extend downwardly from the top 40 in a generally perpendicular manner to form a rectangular container lid 24.

The container base 22 and container lid 24 of the container 20 may be provided by a variety of materials that are inexpensive and capable of retaining liquids. Suitable materials include polypropylene, polyethylene, polystyrene and the like or combinations thereof. For example, the container base 22 may be fabricated from a polystyrene material having a thickness of from about 0.010 inches to about 0.080 inches. The container lid 24 may be fabricated from a combination of a styrene-butadiene-styrene copolymer with a polystyrene material having a thickness of from about 0.005 inches to about 0.060 inches.

The walls 30, 32, 34 and 36 of the container base 22 may be integral with the bottom 28 or may include separate members that are connected or joined to the bottom 28 to provide the container base 22. Similarly, the walls 42, 44, 46 and 48 of the container lid 24 may also be integral with the top 40 or may include separate members that are connected or joined to the top 40 to provide the container lid 24. Desirably, the connections or corners between the walls and the top 40 and bottom 28 of the base 22 and lid 24 are curvilinear to provide a more aesthetically pleasing container 20.

The different components of the container 20 may be provided by conventional techniques such as thermoforming or injection molding as they are known to those of skill in the art. With respect to the containers of the invention, in some embodiments the container base 22 and container lid 24 are provided as integral units. In some cases,

injection molding techniques can be used to form the integral units. When the container base 22 and container lid 24 are separate components, thermoforming techniques typically are used.

In an embodiment of the containers of the invention, the container 20 includes a
5 container base 22 and a container lid 24 as described herein. In addition to a top 40 and front wall 42, rear wall 44 and side walls 46, 48, the container lid 24 can also include a downwardly extending guide ridge 50. The guide ridge 50 generally is parallel to the rear wall 44 of the container lid 24. The guide ridge 50 is generally located close to or proximate the rear wall 44. The rear wall 32 of the container base 22 has an upper portion
10 52. The upper portion 52 is the uppermost portion of the rear wall 32 and, therefore, the portion of the rear wall 32 that comes in closest contact with the container lid 24. The upper portion 52 extends along the full length of the rear wall 32. The upper portion 52 defines a receiving edge 54. The receiving edge 54 is configured to receive the guide ridge 50 of the container lid 24. For example, the receiving edge 54 can be arc-shaped to
15 receive the guide ridge 50. The receiving edge 54 receives the guide ridge 50 as the container lid 24 is closed upon the container base 22.

In one embodiment of the invention, as the container lid 24 is rotated downward toward a closed position, the guide ridge 50 comes into contact with the receiving edge 54 and the receiving edge 54 urges the guide ridge 50 downward and ahead of the receiving
20 edge 54. Therefore, the guide ridge 50 is spaced sufficiently away from the rear wall 44 to be able to land in front of the receiving edge 54 when the container lid 24 is closed on the container base 22. Because the guide ridge 50 extends downward from the top 40 of the container lid 24, the guide ridge 50 can be described as having a "depth" as opposed to a height. The depth of the guide ridge 50 is sufficient to extend below the lowest point or
25 bottom of the receiving edge 54. The combination of the guide ridge 50 and the receiving edge 54 increases the ease with which the container lid 24 can be closed on the container base 22. Further, the guide ridge 50/receiving edge 54 combination assists with the alignment of the container lid 24 onto the container base 22 for purposes of providing a secure closed position. Because the container lid 24 and the container base 22 are
30 aligned properly, the container lid 24 can completely cover the container base 22 and there is a reduced likelihood that the container lid 24 will "pop" off the container base 22. If the container lid 24 becomes partially or entirely detached from the container base 22, moisture will be lost from the wet wipe product stored in the container 20. As a consequence, the wet wipe product loses its ability to perform its intended function.

35 The combination of the guide ridge 50 and the receiving edge 54 also assists with single hand use of the container 20 by permitting a partially open relationship between the

container lid 24 and the container base 22. Typically, existing containers are only capable of maintaining either a completely open or a completely closed position. When only a low quantity of wet wipes remain in a container 20 and the container lid 24 is in the open position, the entire container 20 can tip backwards from the weight of the container lid 24 not being sufficiently counterbalanced. Tipping of the container 20 makes single hand grasping of the wet wipes difficult. The partially open position is achieved when the guide ridge 50 rests on the receiving edge 54. With containers of the invention, the difficulties associated with the container 20 tipping over are overcome while the user can still remove wet wipes from the container 20 with one hand. The container 20 of the invention does not tip over even when no wet wipes remain in the interior 38 of the container 20. Generally, when the container lid 24 is in the partially open position, it is approximately 1.5 inches to 3.0 inches away from the container base 22. For at least these reasons, the containers of the invention are easier to use with a single hand and they are more stable when small numbers of wet wipes remain in the container 20.

The guide ridge 50 and the receiving edge 54 can have a variety of configurations. Typically, the receiving edge 54 is shaped or contoured to at least partially complement the downward facing contour or shape of the guide ridge 50. While the receiving edge has a thickness, the receiving edge 54 is primarily two dimensional. The receiving edge 54 can extend the full length of the upper portion 52 of the rear wall 32 or extend only along part of the length of the upper portion 52. The guide ridge 50 has a length 51 (shown in FIG. 3), a depth 55 (depicted in FIG. 7) and a thickness 53 (depicted in FIG. 3). Generally, the length 51 of the guide ridge 50 is less than the length of the rear wall 44. The guide ridge 50 can desirably have a ratio of the length 51 of the guide ridge 50 to the length of the rear wall 44 of from about 40% to about 90%. In most embodiments, the depth 55 of the guide ridge 50 ranges from about 0.25 inches to about 0.75 inches. The thickness 53 of the guide ridge 50 can range from about 0.0625 inches to about 0.25 inches. The position of the guide ridge 50 against the rear wall 32 of the container base 22 when the container lid 24 is closed is visible in the representative cross-section of a container 20 end depicted in FIG. 7.

As described herein, the containers of the invention can be manufactured out of polymers, copolymers or mixtures of polymers and copolymers. Additional components can be added to provide various functionalities to either the overall container 20 or the individual container base 22 and container lid 24. In one example, the container base 22 is formed from approximately 98% of a high impact polystyrene such as is available from Dow Chemical of Midland, MI as Dow SYTRON® 484. The remainder of the composition of the container base 22 can be an impact modifier such as STEREON® which is

available from the Firestone Company. In an example of a container lid 24 of the invention, the container lid 24 is made of approximately 70% of a styrene-butadiene-styrene copolymer such as FINAPRENE™ Thermoplastic Elastomers, Finaclear 520 available from the Fina Oil and Chemical Company. The container lid 24 can also include
5 approximately 20% of a general purpose polystyrene such as FINA® Polystyrene 524B available from the Fina Oil and Chemical Company. The container lid 24 can further include approximately 10% of a high impact polystyrene such as the Dow SYTRON® 484. If desired, the container lid 24 can include a colorant in an amount of from about 0.08% to about 1.2% by weight. Suitable colorant compounds are known to those of skill in the art.

10 One or the other of the container lid 24 and the container base 22 of the containers of the invention can be transparent, translucent or opaque. There are certain advantages associated with either of the container lid 24 or the container base 22 being transparent or translucent. For example, when the container lid 24 is transparent, the user of the container 20 can readily determine the quantity of wet wipes remaining in the container 20.
15 That is, the user can determine the quantity of wet wipes remaining in the container 20 without having to open the container lid 24 of the container. This is useful, in part, because some wet wipe products are sold without containers in refill packs. The consumer may make intermittent purchases of the wet wipes in a container 20, such as described herein but may also make supplemental purchases of the wet wipes in refill
20 packs. The consumers may refill the container 20 with wet wipes purchased as part of the refill packs. When the container lid 24 and container base 22 are translucent, the container 20 of the invention is desirable for secondary uses. For example, when a consumer no longer uses the container 20 for holding wet wipes, the consumer may want to use the container 20 to store small toys, art supplies and other household items. If the
25 container 20 is translucent, one can see what is inside of the container 20 without having to open the lid 24 or without having to relocate items that may be on top of or around the container 20.

Aesthetic and functional advantages are also obtained when one or the other of the container lid 24 or container base 22 are colored. For example, differently colored
30 containers can be used to distinguish the packaging for different types of wet wipe products. Similarly, aesthetic and functional advantages can be achieved when the container lid 24 or the container base 22 have graphics printed on them. In addition to aesthetic benefits, the graphics can be used to distinguish between various wet wipe product types.

35 As already described herein, the container lid 24 and the container base 22 can be formed of a single integral piece or be formed as separate pieces. With respect to

containers of the invention that are formed from two separate pieces, the container lid 24 is attached or connected to the container base 22 using a variety of techniques known to those of skill in the art. In some embodiments, the container lid 24 and the container base 22 are attached at their rear walls. The rear wall 44 of the container lid 24 can be
5 attached to the rear wall 32 of the container base 22 through the use of glues, adhesives or other bonding agents; through heat sealing; through ultrasonic bonding; or through the use of physical connectors such as pins or interlocking members.

In another embodiment of the present invention, the container 20 includes a container base 22 and a separate container lid 24 that is attached to the container base
10 22. As representatively illustrated in FIGS. 6-8, the rear wall 44 of the container lid 24 has an outwardly extending flange 60. The outwardly extending flange 60 is generally two-dimensional and the flange 60 has a width 61 and a length 63. The outwardly extending flange 60 extends away from the plane of the rear wall 44 in a primarily perpendicular direction. The flange 60 includes three general areas: the area nearest the rear wall 44,
15 that is, the immediately adjacent area 66; the hinge channel 64; and the attachment area 62. The attachment area 62 is located furthest away from the rear wall and the hinge channel 64 is centrally located between the immediately adjacent area 66 and the attachment area 62. Each of the three areas or sections of the flange 60 is primarily linear in shape and each area has an individual length, width and thickness. The three areas
20 are generally parallel to each other and extend in a direction that is primarily parallel to the rear wall 44 of the container lid 24. The rear wall 32 of the container base 22 has a top or upper portion 52 that runs linearly along the portion of the rear wall 32 that is furthest away from the bottom 28. The top portion 52 has an outwardly extending lip 70. The outwardly extending lip 70 is generally planar and extends away from the top portion 52 in a direction
25 that is primarily perpendicular. The container lid 24 is attached to the container base 22 by attachment of the flange 60 to the outwardly extending lip 70. More specifically, the attachment area 62 of the flange 60 is attached to the outwardly extending lip 70.

Therefore, in general terms, the container lid 24 and the container base 22 are attached to each other along their rear walls. The attachment area 62 and the outwardly extending lip
30 70 can be attached to each other using any of the techniques generally known to those of skill in the art. One example of a suitable technique is ultrasonic bonding.

In one embodiment of the invention, the end edges of the flange 60 can be tapered. The tapering of the flange 60 ends results in the ends of the flange 60 being curved. When an end of the flange 60 has a curvilinear shape, the end forms an angle 69,
35 depicted in FIG. 8, away from the rear wall 44 that is less than ninety degrees. In conventional containers, the edge of the hinge between the container lid and container

base can be perpendicular, or at ninety degrees, with the back panel of the container lid. Provision of a curvilinear shape and angle of less than ninety degrees provides several advantages to the container 20. Curvature of the end edges of the flange 60 gives a more user-friendly container 20 in that the flange 60 is less likely to catch on fabric or skin.

5 When the flange 60 edges are tapered along a curve, the immediately adjacent area 66 has the greatest length and the attachment area 62 has the smallest length. While the length of the flange 60 does not typically exceed the length of the rear wall 44, the lengths of the three areas can vary depending on whether and how the tapering is executed. For example, in a particular embodiment, the length of the hinge channel 64 can be from
10 about 60% to about 85% of the length of the rear wall 44. The length of the attachment area 62 can be from about 50% to about 75% of the length of the rear wall 44.

In an additional embodiment of the invention, the hinge channel 64 has two ends, each end of the hinge channel 64 including an end region 68. The hinge channel 64 has a primary thickness and the end regions 68 have a secondary thickness. The secondary
15 thickness of the end regions 68 is generally greater than the primary thickness of the hinge channel 64. For example, the primary thickness of the hinge channel 64 can be from about 0.005 inches to about 0.015 inches. The secondary thickness of the end regions 68 is from about 20% to about 100% greater than the primary thickness. In a similar embodiment, the overall thickness of the outwardly extending flange 60 varies
20 along the width of the flange 60. As with the tapered flange 60 length described herein, the thickness of the flange 60 can have a gradual change across the three areas of the flange 60. An example of the gradual change or tapering of the thickness of the flange 60 is depicted in FIG. 8.

In one example of a flange 60 of the invention, the immediately adjacent area 66
25 has an initial thickness 73 of about 0.040 inches at the point nearest the rear wall 44. The end region 68 of the hinge channel 64 has a thickness 65 of about 0.015 inches; the remainder of the hinge channel 64 has a thickness 67 of about 0.009 inches. The thickness of the flange 60 can then increase over the transition from the end region 68 or hinge channel 64 to the attachment area 62. The attachment area 62 is shown in FIGS.
30 8A and 8B as having a thickness 71 that is approximately the same as the thickness 73 of the immediately adjacent area 66, however the thicknesses 71 and 73 can be different. As shown in FIG. 8A, the thickness 73 of the flange 60 in the immediately adjacent area 66 can gradually thin from about 0.040 inches to about 0.015 inches, the thickness 65 of the end region 68. The thickness 65 of the flange 60 can remain fairly constant over the
35 width of the end region 68. On the other side of the end region 68, the thickness 71 of the flange 60 would gradually increase across the width of the attachment area 62 until the

thickness 71 reached a value of about 0.040 inches. The variation in the thickness 73 of the immediately adjacent area 66, the thickness 67 of the hinge channel 64 and the thickness 71 of the attachment area 62 over the width of the flange 60 is depicted generally in FIG. 8B.

5 With the containers of the invention, performance benefits are seen with a container lid 24 having an outwardly extending flange 60 from the rear wall 44 where the flange 60 has a hinge channel 64 with an end region 68 of a greater secondary thickness 65. When the hinge channel 64 has an end region 68 of a secondary thickness 65, the hinge channel 64 is more resistant to tearing. The hinged areas of conventional
10 containers typically are susceptible to tearing after repeated use. Apparently, the hinge becomes strained over time to the point of tearing from the repeated opening and closing of the lid. In order to demonstrate the improved tear resistance of the containers of the invention, the apparatus depicted in FIGS. 9 and 10 was constructed to simulate repetitive opening and closing of a container lid 24. A representation of a flex test instrument 80 is
15 shown in FIGS. 9 and 10. The flex test instrument 80 can simulate container lid 24 motion on two containers 20 at a time. The flex test instrument 80 includes a motor assembly 82 that is housed approximately in the center of the instrument platform 90. The motor assembly 82 includes a gear motor, motor controller and miter gear. Suitable motor assembly 82 components can be purchased by part number from the following
20 manufacturers: (1) Gear Motor- W. W. Grainger, Part # 4Z539; (2) Motor Controller- W. W. Grainger, Part # 4Z527; and (3) Miter Gear- W. M. Berg, Part # MX-3-D. The motor assembly 82 drives rotating motion arm 84 through a range of motion that emulates the range of motion experienced by a container lid 24 from repeated opening and closing. Relative to the vertical plane, the rotating motion arm 84 moves over a range of from
25 about - 78° to about + 78°. Each cycle of the rotating motion arm 84 is detected and recorded by a counter 92. A suitable counter 92 is part number H7CS-B of the Omron Corporation of Japan, or an equivalent.

FIG. 9 shows operation of the flex test instrument 80 when the container lids 24 are in a virtually closed position and FIG. 10 shows the flex test instrument 80 when the
30 container lids 24 are in an open position. In setting up the flex test instrument 80 to perform a test, the containers 20 are placed on the platform 90 of the instrument 80. The containers are placed between two spacer bars, one in front of the container 20 and one behind the container 20. The rear spacer bars are not visible in the figures. The front spacer bar is an adjustable spacer bar 88 and can be moved rearwardly through rotation
35 of a knob 94 until a position is achieved that firmly holds the container 20 on the platform 90. Each branch of the rotating motion arm 84 terminates with a slotted end 86. The

slotted end 86 slides over and clips to a portion of the front wall 42 of the container lid 24. In order to demonstrate the improved tear resistance associated with the containers of the invention, comparative tests were conducted between a conventional container and a container 20 of the invention using the flex test instrument 80. To represent a
5 conventional container, a HUGGIES NATURAL CARE® container was tested. The container 20 of the invention had a separate container lid 24 with an outwardly extending flange 60. The outwardly extending flange 60 included a hinge channel 64 having a primary thickness 67, the hinge channel 64 having an end region 68 of a greater secondary thickness 65. The primary thickness 67 was about 0.009 inches and the
10 secondary thickness 65 was about 0.015 inches. The flex test instrument 80 was operated at about 50 cycles/min. The conventional HUGGIES NATURAL CARE® container experienced tearing across the entire length of the hinged area after about 9,000 cycles. The representative container 20 of the invention experienced no tearing of the hinge channel 64 after about 28,000 cycles.

15 The present invention is also directed to a wet wipe container 20 having a container lid 24 that is connected to a container base 22 and a closure 56 that is configured to releasably hold the container lid 24 on the container base 22 in a closed position. As illustrated in FIGS. 1-8, the container lid 24 is hingedly connected to the container base 22. The container base 22 includes a front wall 30 that extends upward
20 from a bottom 28. The front wall 30 has a top surface 72. The top surface 72 is in a position that is furthest away on the front wall 30 from the bottom 28. The closure 56 includes an upright tongue projection 58 that is continuous with and extends upward from the top surface 72. The tongue projection 58 has curved edges and is generally semi-circular in configuration. The tongue projection 58 is of a length suitable for gripping. The
25 tongue projection 58 includes a flattened grip area 74. The flattened grip area 74 is approximately of a length that can be easily pushed against by a full size human finger or thumb. The flattened grip area 74 is generally located in the center of the tongue projection 58 and may have a width that is greater than the width of the tongue projection 58. The larger width of the grip area 74 can create a flat surface on the top of the tongue
30 projection 58 for improved performance.

The top surface 72 may also include an arcuate depression 76 that is located primarily below the flattened grip area 74 of the tongue projection 58. In addition to the tongue projection 58 and the arcuate depression 76, the top surface may further include an assistive region 78. The assistive region 78 is positioned below the arcuate depression
35 76 and has a shape that is generally concentric, and therefore semi-circular, with the configuration of the tongue projection 58. The rise of the semi-circular assistive region 78

approaches but does not need to touch the arcuate depression 76. The closure 56 also includes an aperture 98. The aperture 98 is formed within the front wall 42 of the container lid 24. The front wall 42 has a convex portion 96 that extends somewhat outward and away from the front wall 42 in a perpendicularly-oriented direction. The aperture 98 is long enough to accommodate the length of the tongue projection 58. When the container 20 is in a closed position, the tongue projection 58 extends upward through the aperture 98. In another embodiment, the tongue projection 58 could extend downward from the front wall 42 of the container lid 42 and the aperture 98 could be located within the top surface 72 of the front wall 30 of the container base 22.

Either of the container lid 24 and the container base 22 can be transparent or translucent. Further, either of the container lid 24 and the container base 22 can be colored. In some applications, it is desirable to have the container lid 24 be of a different color than the container base 22. If the container lid 24 is colored, the aperture 98 is more visible and the container 20 is easier to close. It is also easier to determine that the container 20 is securely closed when the components of the closure 56 have different colors.

The closure 26 provides a more user-friendly and ergonomic way to open the container 20. The closure 26 of the invention provides for single hand opening and closing of the container 20. Single hand container opening is important for some wet wipe applications such as for diapering of a young child. In the case of baby wipes, often times a parent must use one hand to hold the child while changing a diaper and then must use their other hand to pick up a wipe for cleaning. If the parent does not open the wipe container 20 before beginning the diaper changing process, then they must do it single handedly while changing the diaper. The baby wipe container 20 of the invention is very easily opened with one hand. In one method of opening the container 20, one or two fingers can be placed on top of the tongue projection 58 while the thumb is placed under the convex portion 96 of the container lid 24 and against the assistive region 78. With the fingers in this type of arrangement on the closure 26, the thumb can push against the assistive region 78 to raise the container lid 24 up and over the flattened grip area 74. The guide ridge 50 located on the underside of the top 40 of the container lid 24 maintains the container lid 24 in a partially open position. The partially open position of the container lid 24 prevents the container 20 from tipping over if a small number of wipes remain in the container 20.

In another embodiment, the present invention relates to a wet wipe container 20 that has a container base 22 and a container lid 24 that is connected to the container base 22. The container base 22 includes a bottom 28 and a front wall 30, rear wall 32 and a

pair of opposed side walls 34, 36. The walls extend upward from the bottom 28 in a generally rectangular configuration to provide an interior 38 for containing the wet wipes. The walls may have one or more generally linear ribs 100 formed into the walls. The ribs 100 can be linear or slightly curved. The spacing between the ribs 100 can vary and the
5 ribs 100 can be oriented either horizontally or vertically. As seen in FIG. 5, the ribs 100 are generally horizontal across their length. Where the ribs end at opposite corners of the container, the ends of the adjoined ribs form generally vertical ribs.

FIGS. 11A to 11E, inclusive, in combination with FIGS. 5 and 7, illustrate some examples of configurations for ribs 100. FIG. 11A specifically depicts the configuration
10 illustrated in FIG. 5. FIGS. 11B to 11E, inclusive, illustrate, from a similar perspective, alternate configurations for the ribs 100. A rib generally includes a flat portion of the container wall and an irregular portion 101 adjoining the flat portion(s). An irregular portion can be, e.g., an inward step (FIG. 11A), an outward step (FIG. 11B), a channel (FIG. 11C), or a protrusion (FIGS. 11D and 11E). The irregularity can include curved or
15 sharp edges, such that the u-shaped channels seen in FIG. 11C could be v-shaped, with box-like corners, or with other geometric configurations. In one embodiment, the irregularity can differ from the adjacent flat portions (i.e., stick in or out at their greatest point) in the range of about 0.5 mm to about 5 mm, more preferably from about 1 mm to about 4 mm, and still more preferably from about 2 mm to about 3 mm.

20 The ribs 100 provide several benefits including a more aesthetically appealing appearance and a container base 22 that can be more easily gripped and handled. The ribs 100 make it easier to pick up and hold the container 20. Another benefit of the ribs 100 is that the ribs 100 substantially improve the compression strength of the container 20. During shipping and storage and even during display, containers are stacked
25 vertically on top of each other. Depending on how many containers are stacked, a given container 20 experiences some amount of vertical compression force. Conventional containers are susceptible to crushing and buckling when they have a quantity of containers stacked on top of them. Conventional container lids become crushed in a downward direction and the container bases buckle from the vertical force. The presence
30 of ribs 100 formed into one or more walls of the container base 22 gives the container 20 overall better resistance to compressive forces. Therefore, the containers 20 of the invention experience less crushing and are more resistant to buckling. The ribs 100 can vary in length and can be of varying length within a given wall.

Comparative testing has been performed to demonstrate the improved
35 compression strength of a container with ribs 100. The testing is done, generally, under TAPPI standard procedures and conditions which would be applicable except as

otherwise noted. A standard tensile tester, such as a SINTECH™ Model # 1/G equipped with TestWorks™ 3.10 software for Windows, or comparable equipment, can be used.

Both the Sintech™ test machine and TestWorks™ software are available from MTS Corporation located at 1400 Technology Drive, Eden Prairie, Minnesota, USA. The measurement procedure begins by installing a bottom compression plate (measuring about 30 cm by 30 cm) to the base of the tensile tester. Next an upper compression plate (measuring about 30 cm by 30 cm) is connected to a 91 Kg load cell, making sure the upper plate is parallel to the lower plate. Then the distance between the two plates is adjusted to be about 4.4. inches (11 cm). A container with the lid closed is placed in the center of the lower plate. The tensile tester is then activated so the upper compression plate moves downward and compresses the container at an initial speed of about 10 cm/minute and a test speed of about 25 cm/minute. The upper plate stops after traveling downward for a distance of about 3.2 inches (8 cm). The critical distance here is only what is necessary to generate the yield point, i.e., first spike in the graph, for testing purposes. As of the yield point the container first buckles under the compression force and the subsequent applied force is not relevant to our consideration here. A load (i.e., compression force) versus traveling distance is recorded using the TestWorks™ 3.10 software. FIGS. 12 and 13 demonstrate such a curve for two different runs of the test.

In reference to FIGS. 12 and 13, the test for measuring the compression strength of a container (i.e., without any ribs on the four container walls is seen in FIG. 12, and with ribs on the four container walls and a container like that seen in FIG. 1 is seen in FIG. 12) as explained above was conducted on ten like samples (i.e., ten like that of FIG. 12 and ten like that of FIG. 13). On the curve, the points 110 and 112, respectively, depict where the load first started dropping and these were defined as a yield point. From this time forward, buckling of the container due to compression occurred. The energy at the yield point (e.g., 110 and 112, respectively), which is the area under the curve up to the yield point, was calculated by the TestWorks™ 3.10 software. For the ten samples like that of FIG. 12, the yield load and energy ranged from 73.2 (Lb) and 8.12 (inch-Lb) to 89.3 (Lb) and 11.90 (inch-Lb), with an average yield load and energy of 83.2 (Lb) and 10.21 (inch-Lb). For the ten samples like that of FIG. 13, the yield load and energy ranged from 74.3 (Lb) and 11.36 (inch-Lb) to 87.0 (Lb) and 16.42 (inch-Lb), with an average yield load and energy of 81.2 (Lb) and 13.33 (inch-Lb). Comparing these results, then, one concludes that a container with ribs requires about 30% more energy to cause the walls to buckle. That is, a container with ribs has an enhanced compression strength over a container without ribs, all else held constant. Without being limited to a theory of operation, this enhanced compression strength is believed to be attributable to the increased surface

area the ribs 100 can provide a container wall and/or the way the ribs 100 can more evenly spread out the compression force to the container wall as a whole. Accordingly, the different aspects of the present invention can advantageously provide containers for wet wipes which, when compared to conventional containers for wet wipes, provide

5 improved single handed opening and dispensing. Such containers are particularly useful for dispensing baby wipes since the care giver typically only has one hand free during the diapering process. Thus, the containers for wet wipes of the present invention are reliably and easily opened by one hand of the user or care giver for improved convenience and personal hygiene. Additionally, the containers of the invention can maintain a partially

10 open position of the container lid and provide better alignment between the container lid and the container base. The container lids of the invention are also more tear resistant and are less likely to fail upon repeated opening and closing of the lid. Further, the containers of the invention have improved compression strength and are more difficult to crush.

15 While the invention has been described in detail with respect to the specific aspects thereof, it will be appreciated that those skilled in the art, upon attaining an understanding of the foregoing, may readily conceive of alterations to, variations of, and equivalents to these aspects. Accordingly, the scope of the present invention should be assessed as that of the appended claims and any equivalents thereto.

What Is Claimed Is:

1. A wet wipe container including a container base and a container lid that is connected to the container base comprising:
 - 5 the container base includes a bottom and a front wall, a rear wall and a pair of opposed side walls that extend upwardly from the bottom to provide an interior for containing the wet wipes; and at least one of the walls has a plurality of generally linear ribs formed therein.
- 10 2. The wet wipe container of claim 1 wherein the ribs are oriented vertically.
3. The wet wipe container of claim 1 wherein the ribs are oriented horizontally.
- 15 4. The wet wipe container of claim 1 wherein the ribs are of variable length.
5. The wet wipe container of claim 1 wherein each rib of the plurality of generally linear ribs comprises a flat portion and an irregular portion.
- 20 6. The wet wipe container of claim 5 wherein the irregular portion comprises a member from the group consisting of an inward step, an outward step, a channel, or a protrusion.
- 25 7. The wet wipe container of claim 5 wherein the irregular portion differs from the flat portion adjacent thereto in the range of about 0.5 mm to about 5 mm.
8. The wet wipe container of claim 5 wherein the irregular portion differs from the flat portion adjacent thereto in the range of about 1 mm to about 4 mm.
- 30 9. The wet wipe container of claim 5 wherein the irregular portion differs from the flat portion adjacent thereto in the range of about 2 mm to about 3 mm.
- 35 10. The wet wipe container of claim 1 wherein the plurality of generally linear ribs contribute to improving the compression strength of the at least one wall of the container.

11. A wet wipe container including a container base and a container lid that is connected to the container base comprising:
the container base includes a bottom and a front wall, a rear wall and a pair of
opposed side walls that extend upwardly from the bottom to provide an
interior for containing the wet wipes; and
at least two opposing walls from a group consisting of the front wall, the
back wall and the opposed side walls, each opposing wall having a
plurality of generally linear ribs formed therein wherein the plurality of
generally linear ribs provide an enhanced compression strength to the
respective wall by more evenly spreading out an applied compression
force for the respective walls having the plurality of generally linear ribs
formed therein.
12. The wet wipe container of claim 11 wherein the ribs are oriented vertically.
13. The wet wipe container of claim 11 wherein the ribs are oriented horizontally
and comprise an inward step or an outward step.
14. The wet wipe container of claim 11 wherein the ribs are of variable length.
15. The wet wipe container of claim 11 wherein each rib of the plurality of
generally linear ribs comprises a flat portion and an irregular portion.
16. The wet wipe container of claim 15 wherein the irregular portion differs from
the flat portion adjacent thereto in the range of about 0.5 mm to about 5 mm.
17. The wet wipe container of claim 15 wherein the irregular portion differs from
the flat portion adjacent thereto in the range of about 1 mm to about 4 mm.
18. The wet wipe container of claim 15 wherein the irregular portion differs from
the flat portion adjacent thereto in the range of about 2 mm to about 3 mm.
19. A wet wipe container including a container base and a container lid that is
connected to the container base comprising:

the container base includes a bottom and a front wall, a rear wall and a pair of opposed side walls that extend upwardly from the bottom to provide an interior for containing the wet wipes;

5 a portion of a wall from the group consisting of the front wall, the back wall and the opposed side walls, having a length dimension and a width dimension;

and

10 means for increasing a surface area of the portion of the wall while still maintaining the same length dimension and the same width dimension for the portion of the wall to thereby improve the compression strength of the portion of the wall.

20. The wet wipe container of claim 19 wherein the means for increasing comprises the portion of the wall having a plurality of generally linear ribs formed therein.

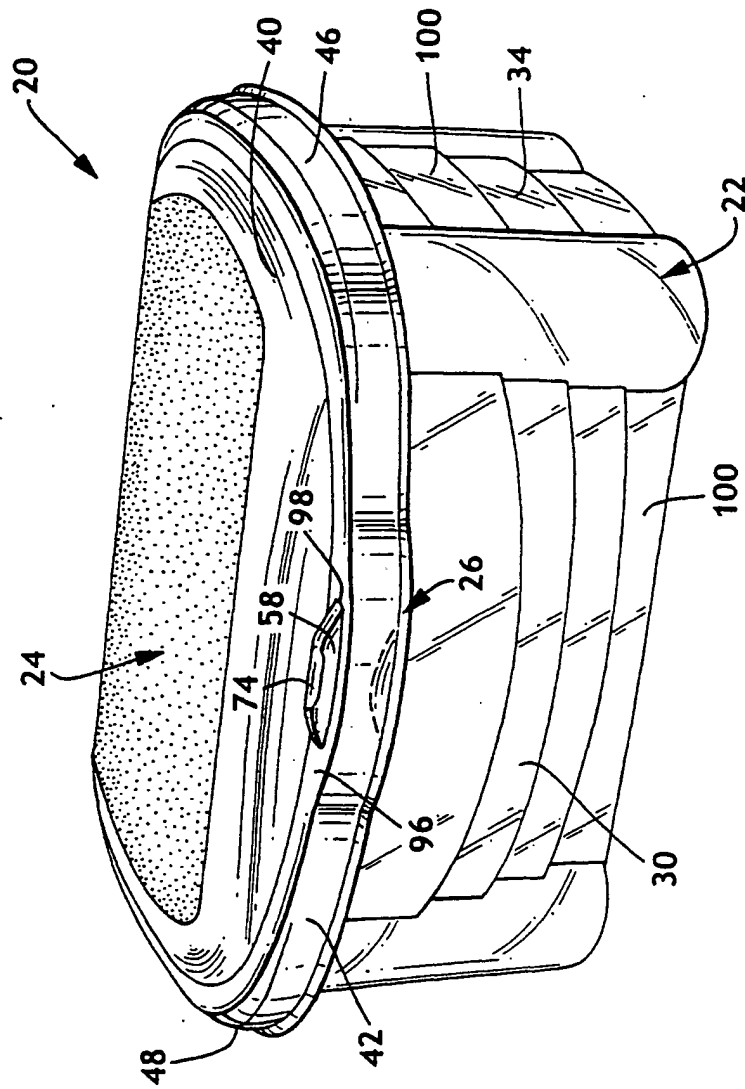


FIG. 1

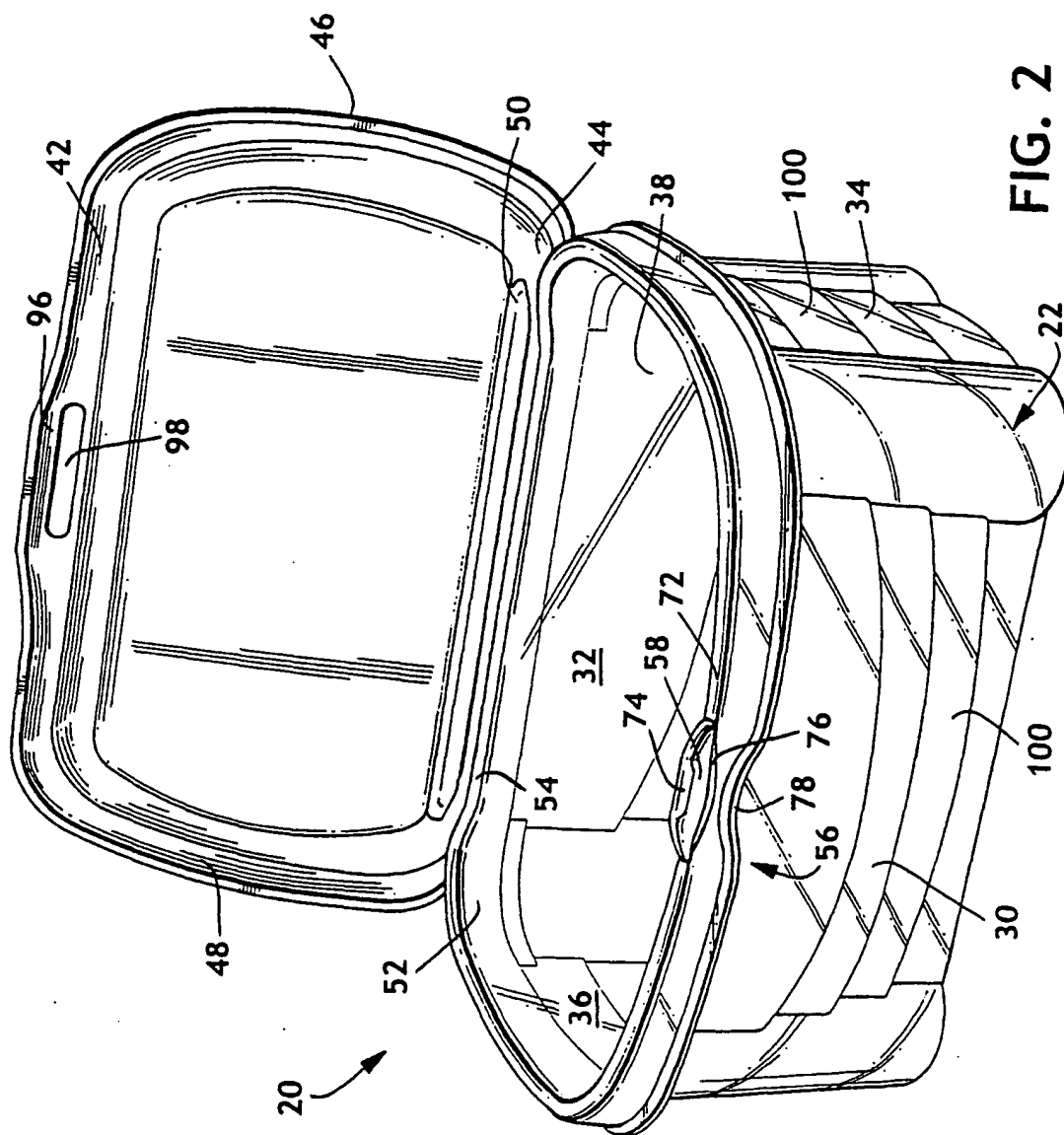


FIG. 2

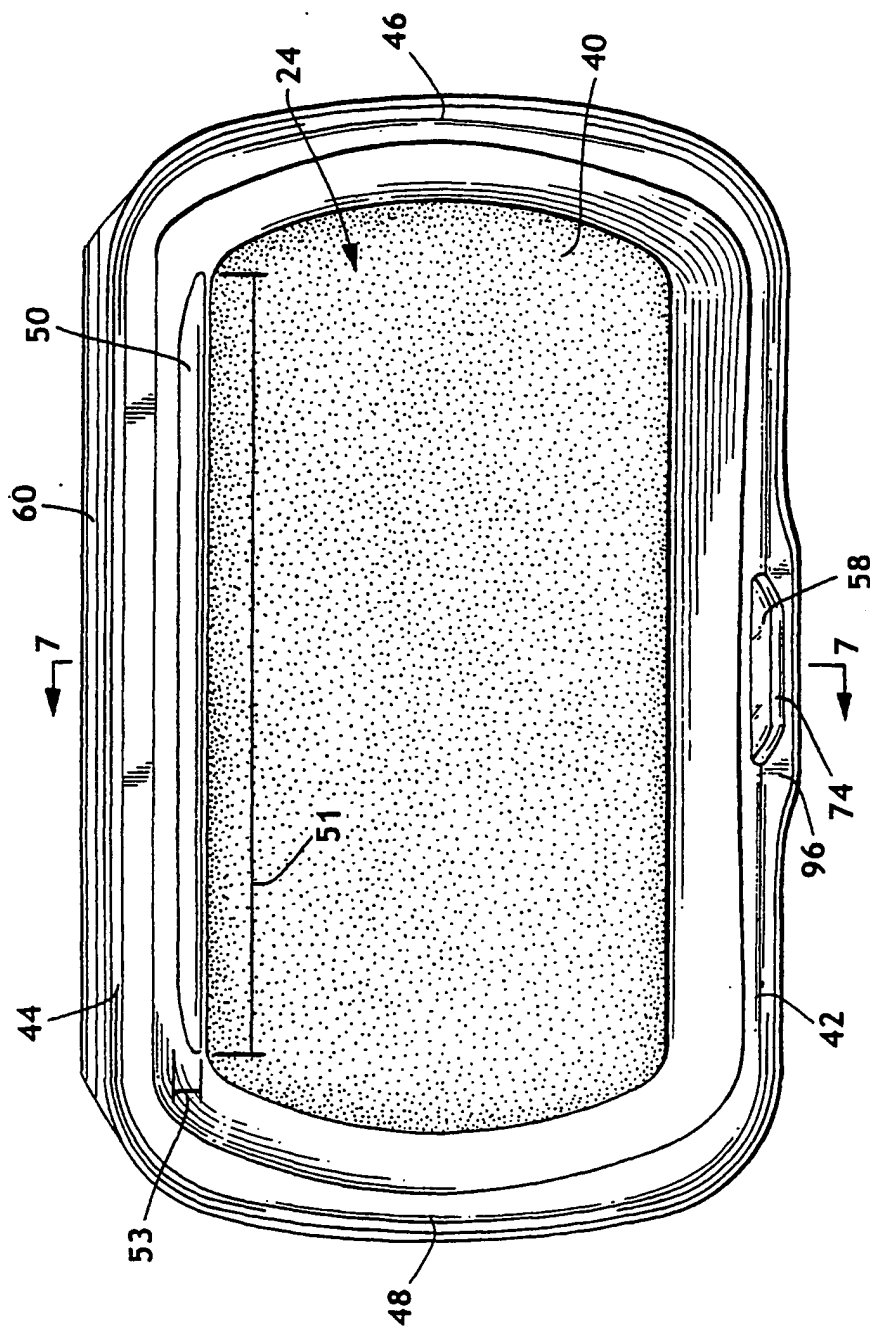


FIG. 3

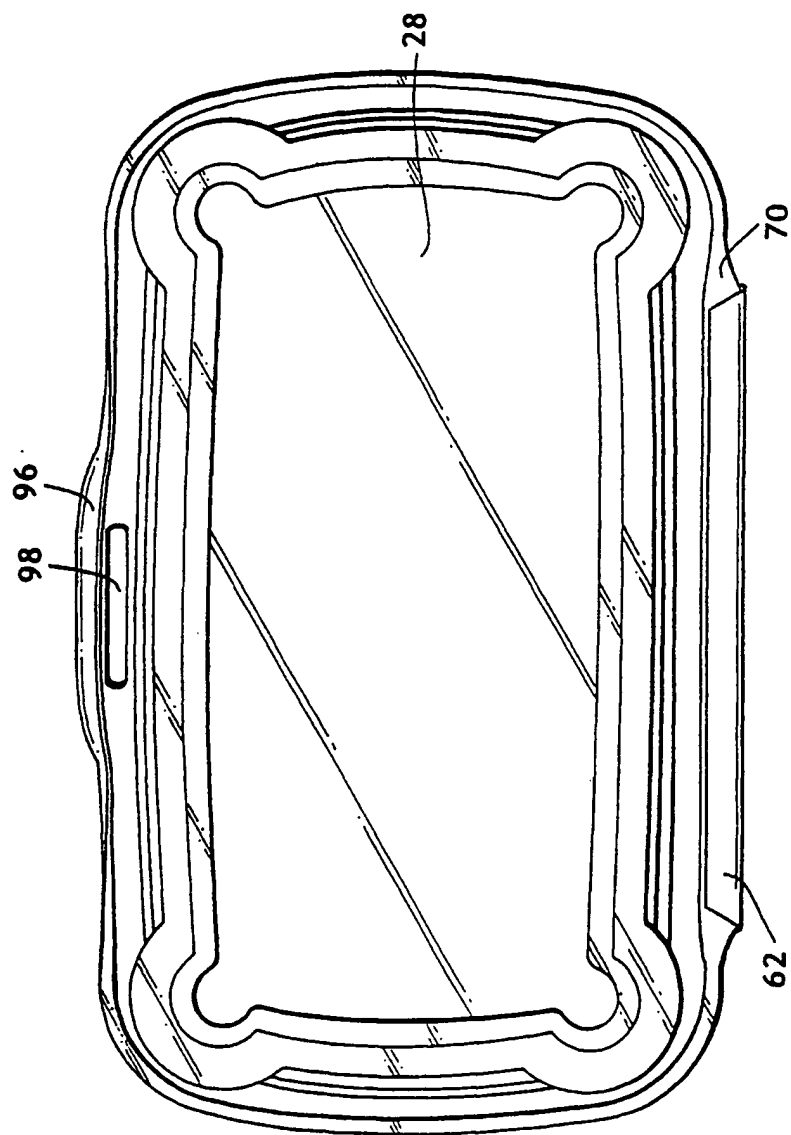


FIG. 4

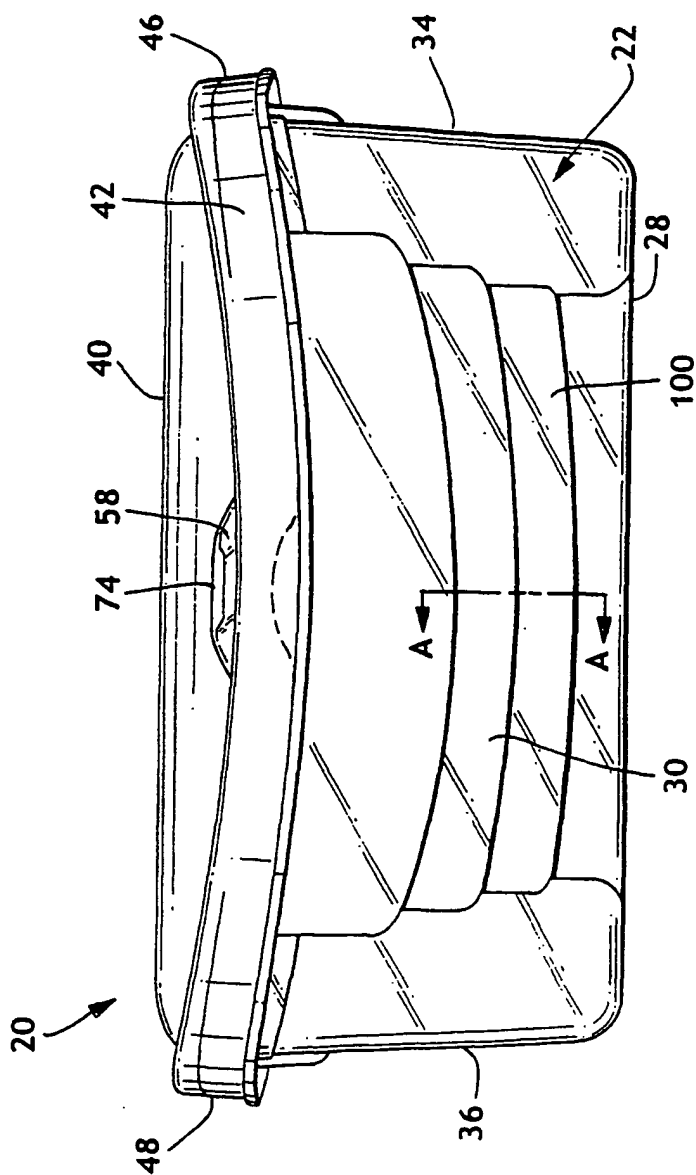


FIG. 5

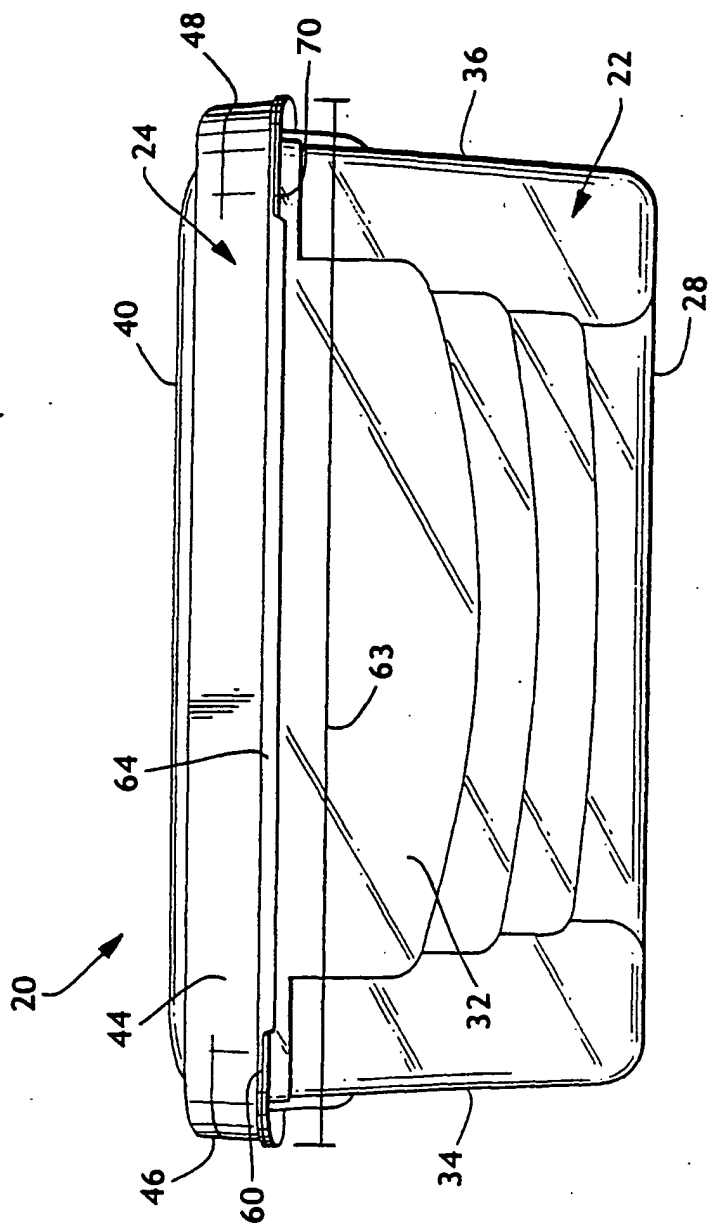


FIG. 6

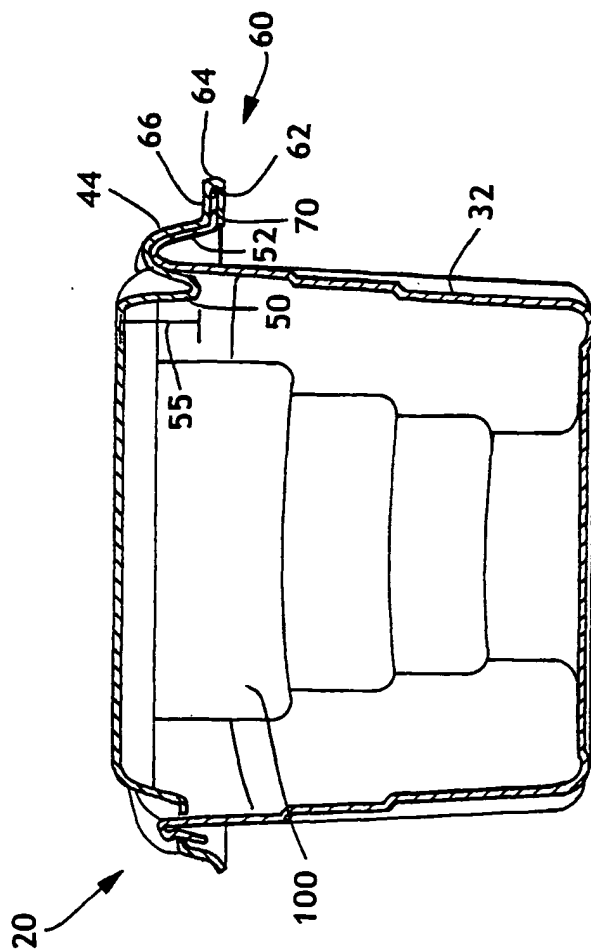


FIG. 7

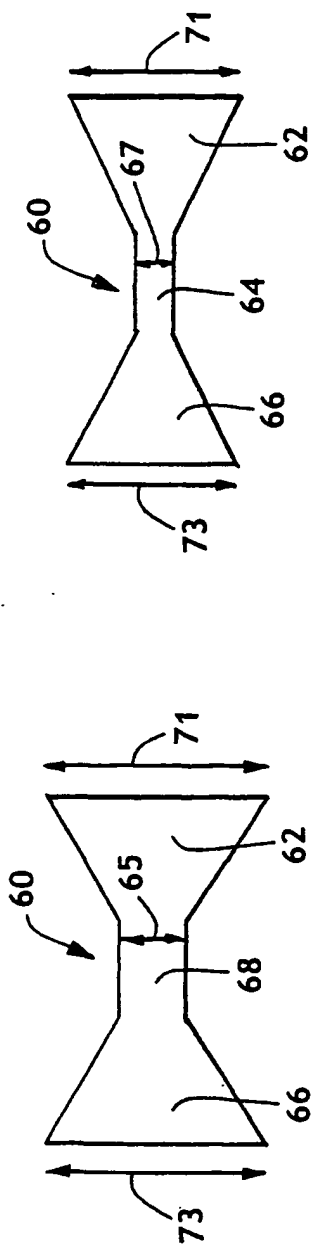


FIG. 8B

FIG. 8A

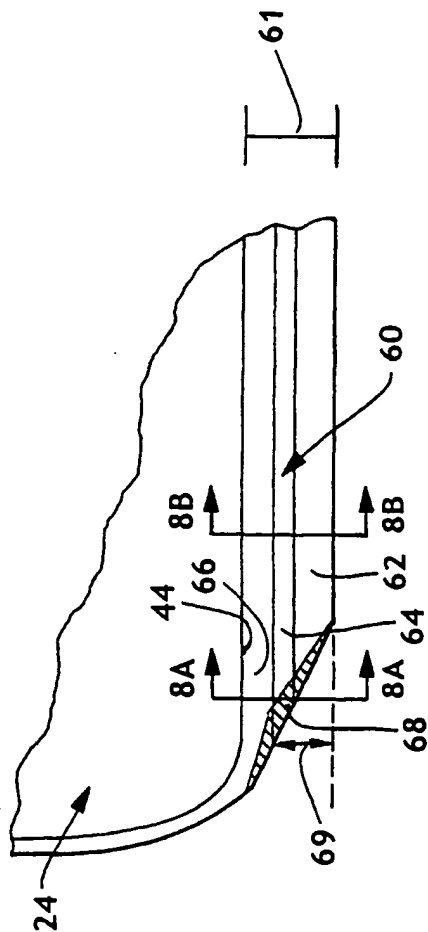


FIG. 8

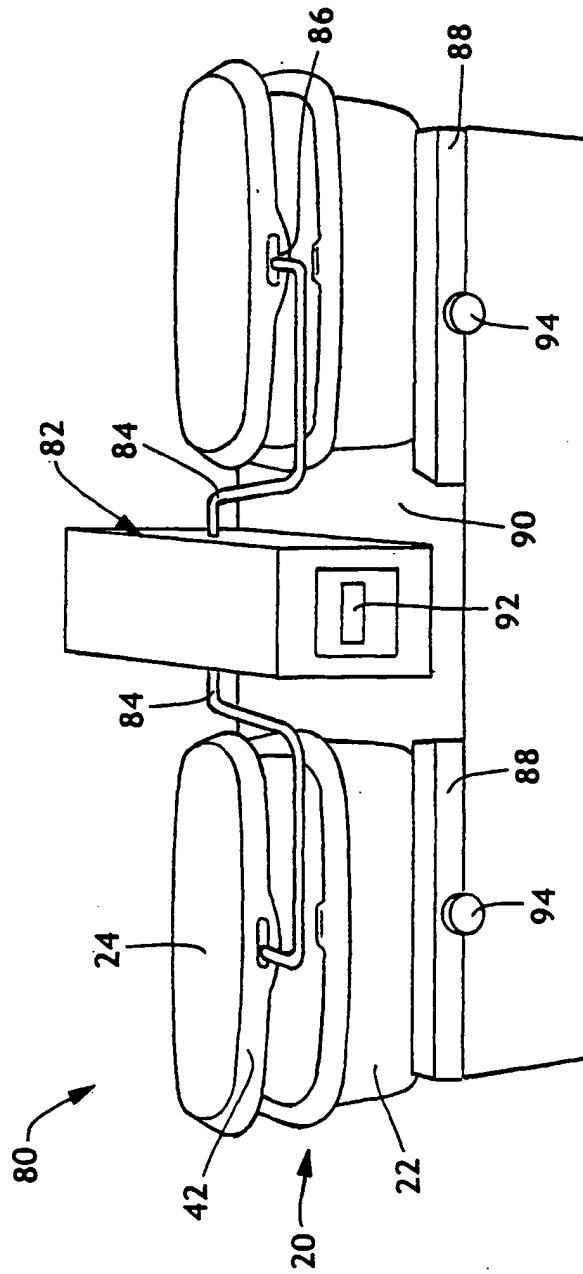


FIG. 9

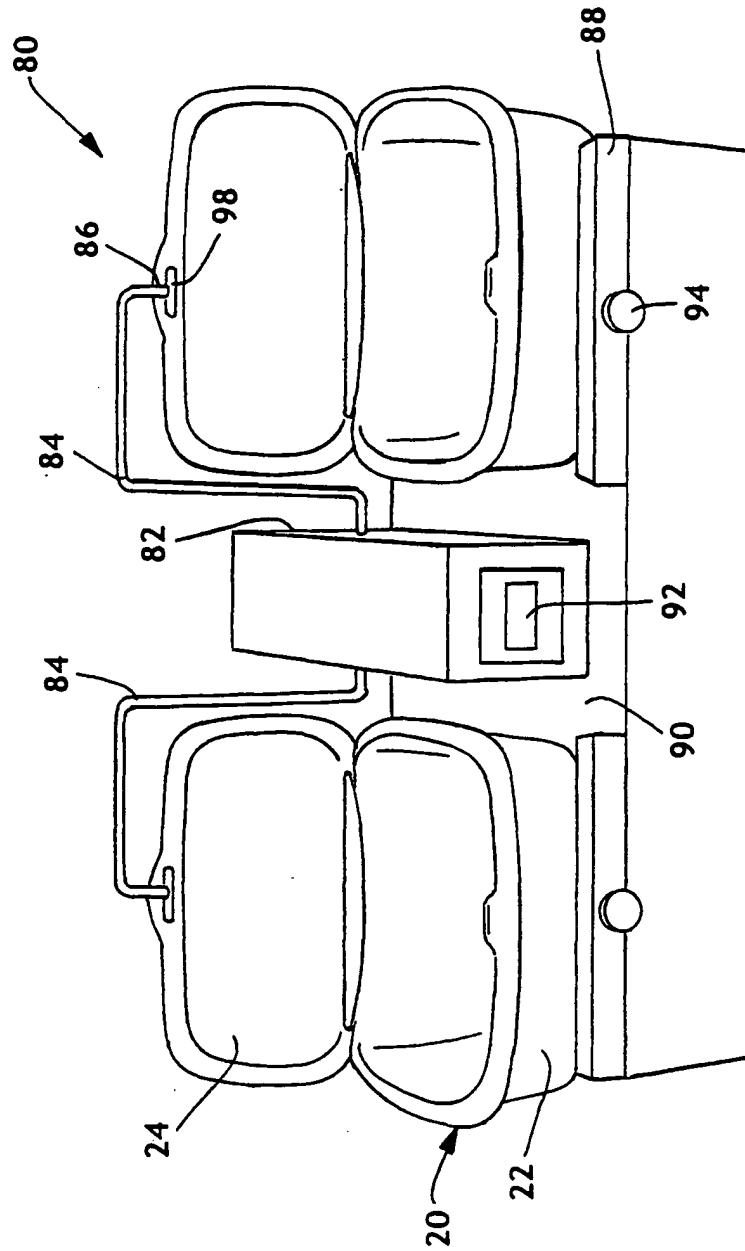


FIG. 10

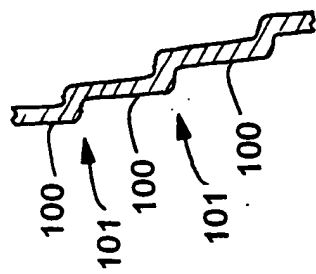


FIG. 11A

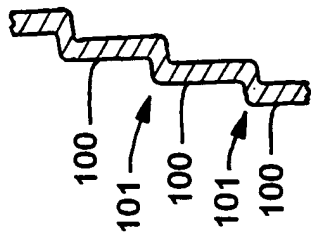


FIG. 11B

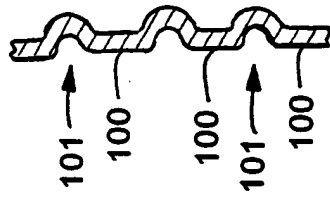


FIG. 11C

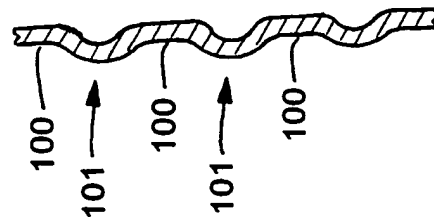


FIG. 11D

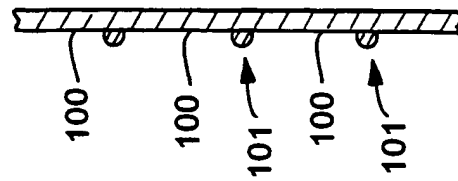


FIG. 11E

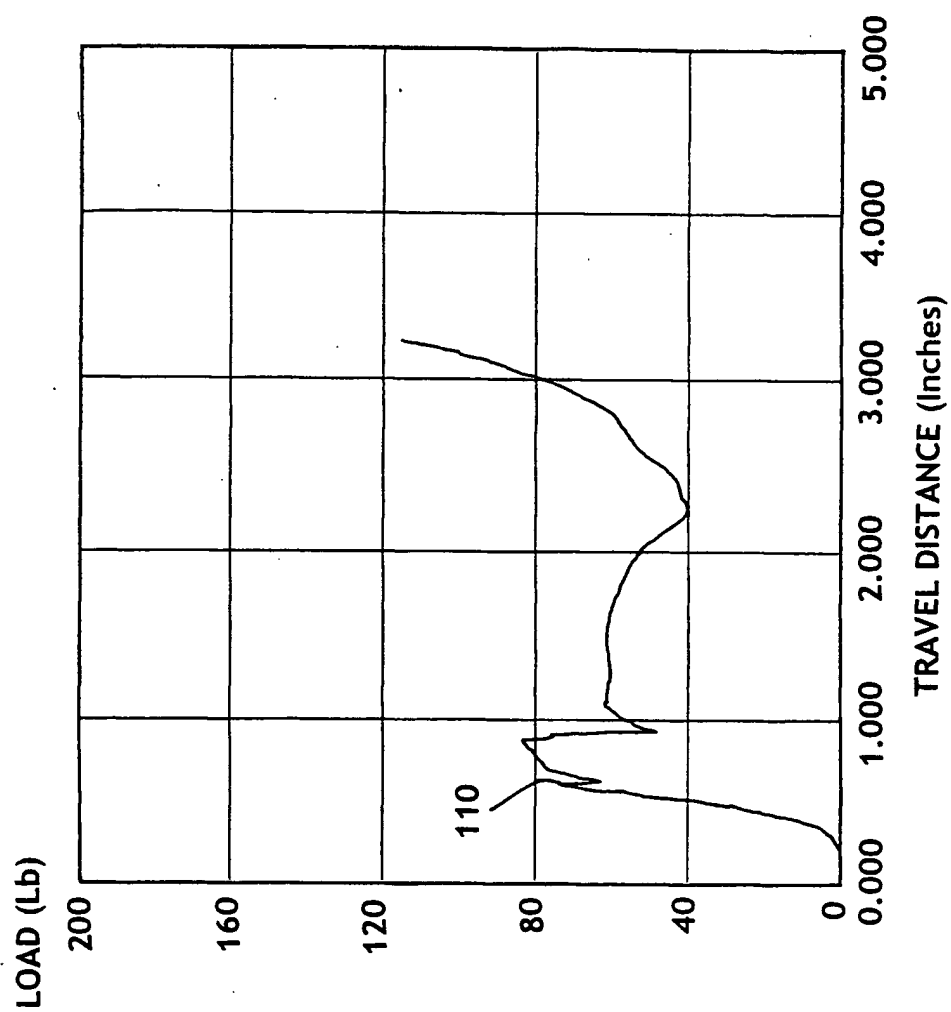


FIG. 12

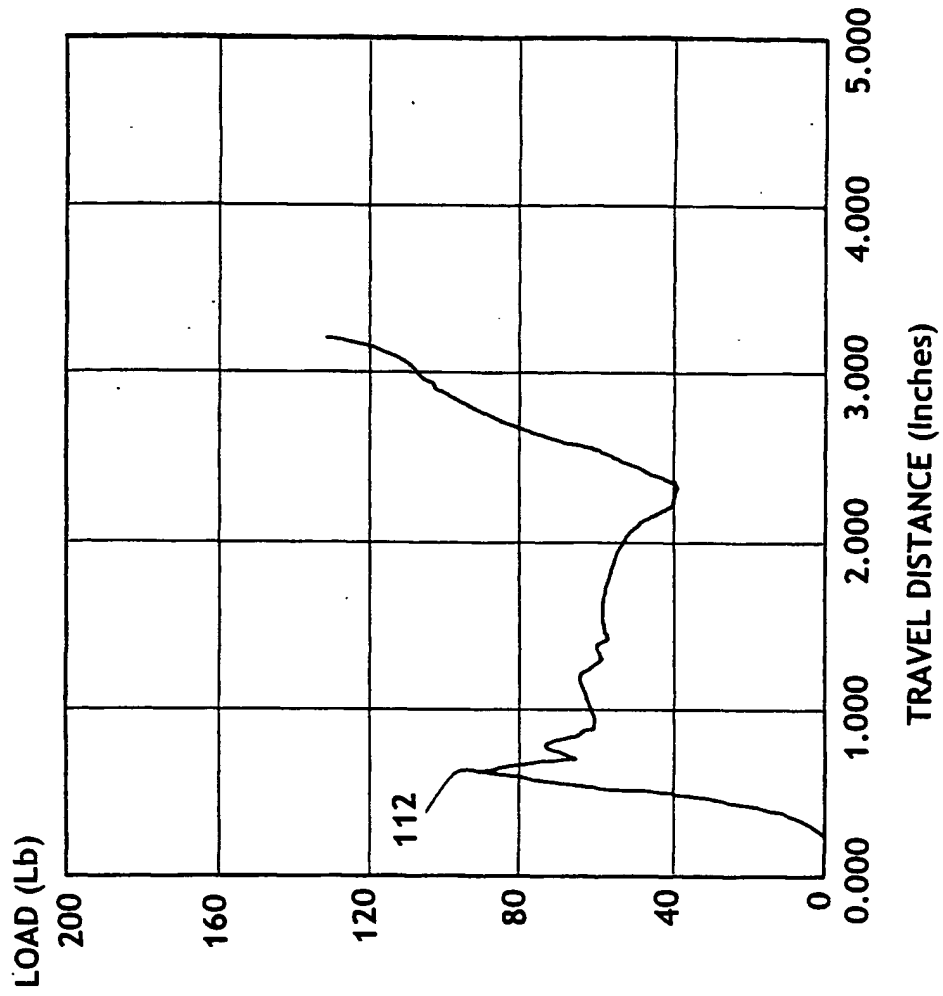


FIG. 13